Spontaneous Bacterial Peritonitis (SBP)

November 17, 2025 by **Josh Farkas**

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SBP

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related topics

- Spontaneous bacterial empyema (SBE) (#spontaneous_bacterial_empyema_(SBE))

presenting clinical features

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presenting signs & symptoms

- SBP is often subtle (for example, 13% of patients are *asymptomatic).* (19266595 (https://pubmed.ncbi.nlm.nih.gov/19266595/))
- Fever or hypothermia.
- Nausea/vomiting, ileus, and/or diarrhea.
- Abdominal pain occurs in about half of patients. However, SBP usually *doesn't* cause frank peritoneal signs or focal pain (if present, *secondary bacterial peritonitis* should be suspected 📖 (#differentiating_spontaneous_versus_secondary_bacterial_peritonitis)).

SBP can cause dysfunction of other organs

- SBP can trigger failure of other organs. In many cases, these other organ failures are more obvious than SBP itself. Consequently, presenting symptoms may center around the failure of other organs:
  - Hepatorenal syndrome. 📖 (https://emcrit.org/ibcc/hrs/)
  - Hepatic encephalopathy. 📖 (https://emcrit.org/ibcc/he/)
  - Gastrointestinal hemorrhage or other bleeding foci may also be the most obvious clinical finding. (SBP itself may lead to a coagulopathy, causing patients with smoldering underlying SBP to present with gastrointestinal hemorrhage).
  - Septic shock can occur (although this may be difficult to sort out from the chronic hyperdynamic circulation often seen in cirrhosis).
- SBP can lead to full-blown acute-on-chronic liver failure (ACLF), a condition marked by multiple organ failures. ACLF has many parallels to septic shock and may be grossly conceptualized as a form of inflammation-induced multiorgan failure that occurs in the context of cirrhosis (more on ACLF: 📖 (https://emcrit.org/ibcc/aclf/)).

paracentesis

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indications for diagnostic paracentesis among inpatients

- **Upon hospital admission:** Any patient with cirrhosis and ascites.
  - SBP is present in ~10% of patients admitted to the hospital with cirrhotic ascites, so it should be suspected in any cirrhotic patient who is admitted to the hospital, *even in the absence of symptoms*. (29653741 (https://pubmed.ncbi.nlm.nih.gov/29653741/))
  - This *includes* admission for GI bleed. (SBP may cause disseminated intravascular coagulation, which may precipitate a GI bleed. So there can actually be a *causal* relationship between infection and bleeding.)
- **After hospital admission:** For patients with cirrhosis and ascites who *deteriorate* in the hospital, with clinical features concerning for SBP, including:
  - Fever, hypothermia, and/or septic shock (paracentesis should be *included* in an infection evaluation).
  - Worsening gastrointestinal symptoms (e.g., nausea, emesis, ileus, abdominal pain).
  - Worsening hepatorenal syndrome and/or hepatic encephalopathy.
- ⚠️ SBP usually occurs in the context of large-volume ascites, which should be easily accessible via paracentesis. If the patient has a *small* volume of ascites that cannot be easily sampled, high-risk paracentesis is not beneficial. Serial ultrasonography may be performed to determine if the ascites expands over time, at which point paracentesis may be reconsidered.

tips on diagnostic paracentesis in the cirrhotic patient

- There is no need to correct the INR or platelet count. (Further discussion of pre-procedure hematology considerations for cirrhotic patients: 📖 (https://emcrit.org/ibcc/cirrhosis/#coagulation_management_prior_to_a_planned_procedure))
- Consider using a very thin lumbar puncture needle (e.g., a 22- or 24-gauge needle).
  - Throw away the stylet and simply attach the needle to a 60-ml syringe.
  - Using a smaller-bore needle decreases the risk of ascites leakage and pain.
- Before needle insertion, look with ultrasonography:

- (a) Confirm that there is a sizable pocket of fluid.
- (b) Measure the thickness of the abdominal wall.
- (c) Use Doppler to exclude the presence of any *arteries* running through the abdominal wall.
- (You don't necessarily have to use real-time imaging while you insert the needle, especially if the pocket is sizable.)

ascitic fluid labs to obtain

- Cell count & differential.
- Gram stain.
- Bacterial cultures:
  - ⚠️ **Culture bottles should be inoculated at the bedside**
    - 10 ml each into an anaerobic bottle and an aerobic bottle. Bedside inoculation increases culture sensitivity to >90%. (33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))
    - A different needle from the one used to obtain the ascitic fluid should be used to transfer the fluid to the culture bottle, to reduce the risk of contamination. (37244043 (https://pubmed.ncbi.nlm.nih.gov/37244043/))
- Total protein, albumin.
- Glucose.
- Lactate dehydrogenase.

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differentiating spontaneous versus secondary bacterial peritonitis

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what is the difference between spontaneous bacterial peritonitis vs. secondary bacterial peritonitis?

- **Spontaneous bacterial peritonitis** involves a single bacterium translocating into the ascites and growing. It is more common and should generally respond to medical

therapy.

- **Secondary bacterial peritonitis** is the presence of perforation or inflammation of an intra-abdominal organ (e.g., cholecystitis) in the presence of ascites. This is much less common than spontaneous bacterial peritonitis. Secondary bacterial peritonitis often *fails* to respond to antibiotics alone, so it's essential to recognize it as a distinct entity.

PulmCrit

Watch on

Right lower quadrant abdominal ultrasound showing features concerning for secondary bacterial peritonitis: (1) Septations (2) Debris visible within the fluid. This patient had a bowel perforation, not spontaneous bacterial peritonitis.

🚩 red flags for secondary bacterial peritonitis

- 🚩 Frank peritoneal signs on exam or localizing abdominal pain.
- 🚩 Complex, loculated fluid seen on ultrasonography (video above).
- 🚩 Multiple different organisms seen on Gram stain or culture.
- 🚩 Failure of medical management for “spontaneous bacterial peritonitis.”
- 🚩 Laboratory criteria: At least two of the following criteria are present in ascitic fluid: (2293571 (https://pubmed.ncbi.nlm.nih.gov/2293571/))
    - Total protein >1 g/dL.
    - Glucose <50 mg/dL (2.8 mM).

- Lactate dehydrogenase above the upper limit of normal for serum (~225 U/ml).

evaluation for suspected secondary bacterial peritonitis

- The key test is a CT scan of the abdomen/pelvis to exclude any focus of infection requiring source control.
- If biliary pathology is suspected, right upper quadrant ultrasonography may also be helpful.

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diagnosis of SBP

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diagnostic criteria for SBP

- Three criteria are required:
  - [1] Chronic underlying cirrhosis.
  - [2] Ascites neutrophil count >250/mm3.
  - [3] Exclusion of secondary bacterial peritonitis (discussed in the section above).
- Ascitic fluid cultures are often negative, so SBP is often diagnosed without microbiological proof of infection.

monomicrobial non-neutrocytic bacterascites

- This is defined as an ascitic fluid culture *positive* for a single organism, yet the neutrophil count is <250/mm3.
- Guidelines recommend that patients should *not* receive antibiotics, since most cases are either due to contamination or may self-resolve over time. Repeat paracentesis should be performed to investigate for progression to SBP. (33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))

prompt diagnosis is important ⏰

- SBP has the capacity to cause organ failures, with many parallels to septic shock.

- Diagnostic paracentesis should be performed promptly (e.g., <12 hours after admission to the hospital, for patients with cirrhosis and ascites). (34182617 (https://pubmed.ncbi.nlm.nih.gov/34182617/))

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treatment

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Spontaneous bacterial peritonitis may push patients into a state of decompensated cirrhosis (marked by hypotension, malperfusion, and hepatorenal syndrome). The following treatments should be implemented promptly to avoid this.

#1/4: antibiotics

- Empiric antibiotics should be initiated as soon as ascitic fluid demonstrates spontaneous bacterial peritonitis.
- Coverage is needed for gram-negative bacilli and also for selected gram-positive organisms. Most commonly isolated organisms include Escherichia coli, Klebsiella pneumoniae, Staphylococcus aureus, Enterococcus faecalis, and Enterococcus faecium. (33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))
- **Community-acquired SBP with low risk for multidrug-resistant organisms:**
  - Ceftriaxone 💉 (https://emcrit.org/ibcc/antibiotics/#cephalosporin_G3:_ceftriaxone) 2 grams IV daily is the usual therapy.
  - SBP + septic shock: Consider broader therapy (e.g., piperacillin-tazobactam). (33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))
- **Nosocomial SBP (or healthcare-associated SBP):**
  - Broader coverage is appropriate (e.g., piperacillin-tazobactam or a carbapenem).
  - Antibiotic selection will vary depending on the hospital's antibiogram and whether the patient has recently been colonized or infected with any drug-resistant organisms.

- **Narrowing & weaning antibiotics:**
    - If ascitic fluid cultures are positive, antibiotics should be narrowed appropriately (SBP is a mono-microbial process, so you only need to cover a single organism).
    - The recommended duration of antibiotic therapy is 5-7 days. (33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))

#2/4: albumin

- **Albumin** has been proven to reduce the incidence of hepatorenal syndrome and mortality. (10432325 (https://pubmed.ncbi.nlm.nih.gov/10432325/)) The treatment regimen is 1.5 g/kg of 20% albumin at the time of diagnosis, followed by 1 g/kg of albumin 48 hours later.
    - The seminal RCT demonstrating the benefit of albumin used 20% albumin. (10432325 (https://pubmed.ncbi.nlm.nih.gov/10432325/))
- There is debate about whether albumin may be omitted in patients at low risk for hepatorenal syndrome, based on a *retrospective subgroup* analysis. However, omission of albumin hasn't been adequately validated in this subgroup. Furthermore, a meta-analysis concluded that albumin caused improvements, *regardless* of disease severity. (32533951 (https://pubmed.ncbi.nlm.nih.gov/32533951/))

#3/4: evaluate patient's antihypertensives & nephrotoxic medications

- Discontinue beta-blockers, as these may increase the risk of hypotension and hepatorenal syndrome. (24631577 (https://pubmed.ncbi.nlm.nih.gov/24631577/)) If the blood pressure is robust (MAP >> 65 mm) and there is no concern for renal dysfunction, beta blockers *might* be continued (though this situation would be incredibly unusual, since most patients with SBP have borderline hemodynamics). (33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))
- Consider holding other antihypertensives or vasodilators as well (especially ACE inhibitors or ARBs).

- Discontinue or avoid any nephrotoxins (listed here: 📖 (https://emcrit.org/ibcc/aki/#nephrotoxins)).

#4/4: repeat paracentesis after 48 hours

- Guidelines recommend usually repeating a paracentesis after >48 hours.(33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))
    - Paracentesis may be unnecessary if a single organism is isolated from the original paracentesis, the organism is susceptible to the antibiotic therapy, and the patient is improving clinically.(33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))
- Re-culturing may be useful to exclude the possibility of bacterial resistance.
    - (As discussed above, ascitic fluid should be inoculated into blood culture bottles at the bedside.)
- If the neutrophil count doesn't decrease by at least 25%, this carries a substantial likelihood of treatment failure.(29653741 (https://pubmed.ncbi.nlm.nih.gov/29653741/))
    - Re-consider the possibility of secondary bacterial peritonitis (and consider a CT scan of the abdomen/pelvis).(33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))
    - Escalation to broader antibiotics may be considered.(33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))

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spontaneous bacterial empyema (SBE)

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definitions & terminology

hepatic hydrothorax

- In some patients with cirrhosis, ascitic fluid *tracks* into the pleural space, leading to a

pleural effusion (commonly termed “hepatic hydrothorax”). This may result from tiny holes in the diaphragm and the negative pressure of the thorax, causing ascitic fluid to be drawn into the chest.

- The overall pathophysiology of hepatic hydrothorax is largely identical to that of ascites (e.g., treatment may involve diuretics and TIPS to reduce the portal pressure).

spontaneous bacterial empyema (aka, spontaneous bacterial pleuritis)

- Spontaneous bacterial empyema is a superinfection of hepatic hydrothorax in the *absence* of pneumonia.
- This may occur in various different ways:(Light 2016)
    - Roughly half occur as a *primary infection* of the pleural space (*without* concomitant spontaneous bacterial peritonitis).
    - Roughly half occur simultaneously with spontaneous bacterial peritonitis (perhaps representing *spread* of infection from the abdomen into the pleura).
- 💡 Spontaneous bacterial empyema is essentially a thoracic version of spontaneous bacterial peritonitis.

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epidemiology & clinical features

epidemiology

- Spontaneous bacterial empyema is reported in ~14% of hospitalized patients with cirrhosis and a significant pleural effusion.(35978675 (https://pubmed.ncbi.nlm.nih.gov/35978675/))

clinical features of spontaneous bacterial empyema may include:

- Clinical manifestations are similar to spontaneous bacterial peritonitis. Like SBP, inflammation may be muted in the context of cirrhosis – so symptoms may be unimpressive.
- (1) Localizing symptoms, such as chest discomfort or respiratory failure.
- (2) Systemic manifestations of infection:

- Fever, chills.
- Organ dysfunction (e.g., encephalopathy, hypotension, hepatorenal syndrome).

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diagnosis

when is a thoracentesis indicated?

- Precise indications for thoracentesis are *unclear*.
- Indications to perform thoracentesis might include:
  - Clinical suspicion of infection.
  - *New* development of a pleural effusion.
  - *Rapid enlargement* of a pre-existing pleural effusion.
  - Therapeutic relief from respiratory failure.
- 💡 Whenever a patient with cirrhosis receives a thoracentesis for any reason, pleural fluid should be analyzed for cell count and microbiology to exclude spontaneous bacterial empyema.
- 💡 If you're thinking about the possibility of SBP, you should also be thinking about the possibility of spontaneous bacterial empyema.

pleural fluid analysis in spontaneous bacterial empyema

- The overall pattern of pleural fluid labs doesn't usually resemble a typical empyema: (Murray 2022)
  - Glucose can be normal.
  - LDH is usually elevated, but fluid can be transudative.
  - pH is occasionally <7.30.
- Pleural fluid culture is positive in most patients (yield may be improved substantially by inoculation of blood culture bottles at the bedside).

diagnostic criteria for spontaneous bacterial empyema:

- Three criteria are required:
  - (1) Chronic underlying cirrhosis.

- (2) Pleural effusion with neutrophil count >250/mm3.
- (3) Exclusion of an alternative diagnosis (e.g., underlying pneumonia).
    - Any alternative infectious focus must be excluded (e.g., intra-abdominal pathology, or pneumonia). If pleural fluid studies are unusually inflammatory, consider CT scan of the chest, abdomen, and pelvis to exclude a focus of infection ("secondary bacterial empyema").
    - ⚠️ If multiple species are cultured or seen on gram stain, this suggests secondary empyema (e.g., due to bronchopleural fistula or mediastinitis).
- These diagnostic criteria are essentially the same as for spontaneous bacterial peritonitis. Some sources disagree about the neutrophil cutoff to use for spontaneous bacterial empyema (either >250/mm3 versus >500/mm3). The 250/mm3 cutoff is recommended by the most recent AASLD guidelines.(33942342 (https://pubmed.ncbi.nlm.nih.gov/33942342/))

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treatment

treatment is largely identical to the treatment of SBP

- (1) All of the treatments for SBP described above should be utilized. 📖 (#treatment)
- (2) The only difference in treatment is the issue of whether to place a chest tube (discussed below).

chest tube drainage is typically not indicated

- Unlike other empyemas, chest tube drainage is usually not helpful.
    - Chest tubes are relatively contraindicated in cirrhosis, due to concerns regarding excessive fluid shifts.
- Indications for tube drainage might include:
    - (1) Frankly purulent pleural fluid (but *this is uncommon for spontaneous bacterial empyema*, and would suggest another type of empyema).
    - (2) pH <7.1
    - (3) Failure to respond to medical management (e.g., serial thoracentesis showing worsening of pleural fluid chemistries over time).

questions & discussion

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To keep this page small and fast, questions & discussion about this post can be found on another page ***here*** (https://emcrit.org/pulmcrit/sbp/) .

Guide to emoji hyperlinks

- 🧮 = Link to online calculator.
- 💉 = Link to IBCC section about a drug.
- 📖 = Link to IBCC section covering that topic.
- 🌊 = Link to FOAMed site with related information.
- 📽️ = Link to supplemental media.

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